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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/870,534	05/31/2001	Kamalesh K. Srivastava	FIS920000349US1	1332
32074 7590 06/19/2008 INTERNATIONAL BUSINESS MACHINES CORPORATION DEPT. 18G BLDG. 300-482 2070 ROUTE 52 HOPEWELL JUNCTION, NY 12533				
EXAMINER				
ANGADI, MAKI A				
ART UNIT		PAPER NUMBER		
1792				
MAIL DATE		DELIVERY MODE		
06/19/2008		PAPER		

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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* KAMALESH K. SRIVASTAVA,  
MARY C. CULLINAN-SCHOLL, LISA A. FANTI,  
JONATHAN H. GRIFFITH, and RANDOLPH F. KNARR

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Appeal 2008-2031  
Application 09/870,534  
Technology Center 1700

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Decided: June 19, 2008

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Before BRADLEY R. GARRIS, CHUNG K. PAK, and  
KAREN M. HASTINGS, *Administrative Patent Judges*.

HASTINGS, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 from the Examiner's decision rejecting claims 1-12, 14 and 15. We have jurisdiction under 35 U.S.C. § 6.

We AFFIRM.

## BACKGROUND

Appellants claim a method for improving the uniformity of etching a film having a plurality of solder bumps on an article, namely, a semiconductor wafer. Appellants, in the Background of the Invention section of the Specification, describe that a problem when etching these wafers was that the film etches slower at the kerf area of the semiconductor chip where there are usually no solder bumps (Spec. paragraph bridging p. 3-4; kerf area 36 shown on Fig. 1). Appellants describe that their solution to this problem is rotating the wafer while in the etchant to improve the uniformity of etching the film (Spec. paragraph bridging p. 5-6).

Claim 8 is illustrative:

8. A method of improving the uniformity of etching of a film having a plurality of solder bumps on a semiconductor wafer, the method comprising the steps of:

immersing the semiconductor wafer containing the film having a plurality of solder bumps into a tank of etchant;

rotating the semiconductor wafer while in the etchant for an amount of time; and

removing the semiconductor wafer from the tank of etchant.

The references set forth below are relied upon by the Examiner as evidence of obviousness:

Erk	5,340,437	Aug. 23, 1994
Barbee	5,445,705	Aug. 29, 1995
Datta	5,462,638	Oct. 31, 1995
Takeshi (as translated)	JP 9115977A2	May 2, 1997

The Examiner rejected claims 1, 4-6, 8, 11, 12 and 14 under 35 U.S.C. § 103(a) as being unpatentable over Erk in view of Datta. To reject claims 2, 3, 9, and 10 under 35 U.S.C. § 103(a), the Examiner added Takeshi to the combination of Erk and Datta. To reject claims 7 and 15 under 35 U.S.C. § 103, the Examiner added Barbee to the combination of Erk and Datta.

Appellants do not argue with any reasonable specificity any of the individual claims rejected by the combination of Erk and Datta. Therefore, we select independent claim 8 to decide the first ground of rejection. Appellants separately address dependent claims 2, 3, 9, and 10 as a group. We select claim 9 to represent this claim group. Appellants present no arguments with respect to dependent claims 7 and 15.

#### ISSUES ON APPEAL

The issues on appeal arising from the contentions of Appellants and the Examiner are whether the Appellants have shown that the Examiner reversibly erred in rejecting the claims because:

(a) there is no prima facie case of obviousness since Erk does not fairly teach or suggest the use of rotating any wafers other than work-damaged wafers for processing by the rotating etching process;

(b) if there is a prima facie case of obviousness, the asserted prima facie case has been overcome by Appellants' showing of unexpected results via the comparative data in the Specification; and

(c) there is no prima facie case of obviousness for "sequentially rotating the wafer" as called for in dependent claim 9 because Takeshi is nonanalogous art.

## OPINION

We agree with the Examiner's findings of facts and legal conclusions of obviousness as set out in the Answer. We have thoroughly reviewed each of Appellants' arguments and evidence for patentability. However, we are in full agreement with the Examiner that the claimed subject matter would have been obvious to one of ordinary skill in the art within the meaning of § 103 in view of the applied prior art. Accordingly, we will sustain the Examiner's rejections for essentially those reasons expressed in the Answer and those set out herein.

### *The issue of prima facie obviousness*

The Examiner correctly finds that Erk teaches a method of etching a semiconductor wafer that comprises all the claimed steps except that Erk fails to teach that the wafer being etched contains a film having a plurality of solder bumps (Ans. 3, 6). Erk describes that "relatively slow" rotation of the wafer during the etching process improves the uniformity of the etching process (see, e.g., "the "wafers can be *uniformly* etched at relatively slow rotation speeds" at col. 2, ll. 18-19; emphasis provided; Ans. 10). Also correct is the Examiner's finding that Datta teaches dip etching a semiconductor wafer containing a film having solder bumps in order to remove the film in between the solder bumps (Ans. 4, 7).

The Examiner acknowledges that Erk fails to explicitly teach that the wafer being etched contains a film having a plurality of solder bumps as required by independent claim 8, but, based on the above-noted findings, concludes that it would have been obvious for one with ordinary skill in this art to have employed any wafer, including a wafer having a film with solder

bumps thereon as claimed, based on a reasonable expectation of successfully achieving uniform etching (Ans. 7, 8).

Appellants contend there is no prima facie case for the Examiner's conclusion that it would have been obvious to rotate the wafer of Datta while etching it since Erk is directed to the etching of bare silicon wafers, and there is nothing to suggest applying the teaching of Erk to any other wafer or process (App. Br. 6; Reply Br. 2). Appellants also contend that the references combined by the Examiner do not suggest the problem found by Appellants nor its solution (Br. 5-6). We do not find these arguments persuasive.

As recently stated by the Supreme Court in *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740-41 (2007):

Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.

The Supreme Court further noted in *KSR* that an obviousness analysis “need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” 127 S. Ct. at 1741. Further, the combination of familiar elements (or steps) is likely to be obvious when it does no more than yield predictable results, and the question is whether the improvement is more than the predictable use of prior art elements (or steps) according to their established functions. *KSR*, 127 S. Ct. at 1739-1740.

As discussed above, Datta teaches it is necessary to etch the film on a semiconductor wafer with solder bumps in order to remove the film. We determine that rotating the semiconductor wafer of Datta during etching is a predictable use of a known prior art step in order to achieve the predictable result of more uniform etching (i.e., to remove the film of Datta) as taught in Erk. Appellants have not shown that there is more than a predictable result flowing from such a rotating step as taught in Erk.

*KSR* also makes clear that it is not necessary for the prior art to recognize the same problem and solution as the Appellant. *KSR*, 127 S. Ct. at 1742 ( “Under the correct analysis, any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed”). While Erk may not be concerned with the exact same problem as Appellants, patentee is concerned with the problem of nonuniformity when etching semiconductor wafers. Erk’s solution is that “slow” rotation of the semiconductor wafer in the etchant improves etching uniformity.

Thus, we agree with the Examiner's conclusion that it would have been *prima facie* obvious for an artisan to rotate the wafer containing solder bumps of Datta. Again, this conclusion is supported by Erk’s teaching that rotating a wafer during etching produces a uniform etching. This teaching would have given the artisan a reasonable expectation that rotating any wafer that needed to be etched, including the film on the wafer of Datta, would have been an effective step in the etching process. *See Pfizer, Inc. v. Apotex*, 480 F.3d 1348, 1364 (Fed. Cir. 2007) (the expectation of success need only be reasonable, not absolute).

Having determined that a prima facie case of obviousness exists with respect to representative claim 8, we now proceed to an evaluation of Appellants' proffered evidence of nonobviousness.

*The ultimate issue of obviousness versus nonobviousness*

*Unexpected Results*

When prima facie obviousness has been established, we must begin our consideration anew and consider the evidence of obviousness against the evidence of non-obviousness (such as the data in Appellants' Specification). *See In re Oetiker*, 977 F. 2d 1443, 1445 (Fed. Cir. 1992). The burden rests with Appellants to establish that the results are unexpected, based on comparisons with the closest prior art, and commensurate in scope with the claimed subject matter. *See, e.g., In re Klosak*, 455 F.2d 1077, 1080 (CCPA 1972); *In re Kulling*, 897 F. 2d 1147, 1149 (Fed. Cir. 1990). We determine that Appellants have not met this burden. We determine that Appellants' evidence of non-obviousness is insufficient to overcome the rejection for at least the following reasons.

As evidence of nonobviousness in the form of unexpected results, Appellants refer to the Specification. According to Appellants, "[a]ssuming arguendo that the combination of Erk and Datta might result in some improvement in etching, the amount of the improvement found by Appellants is surprising and unexpected." (App. Br. 8; Reply Br. 3).

First, we determine that the Examples in the Specification do not show "unexpected" results. While Appellants results may evidence superior results, they do not establish unexpected results. *See Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1371 (Fed. Cir 2007) ("[B]y definition, any superior property must



be unexpected to be considered evidence of non-obviousness”). Erk illustrates that the use of a relatively slow rotation of less than about 5 rpm improves the uniformity of an etching process for semiconductor wafers (*see, e.g.*, col. 4, ll. 22-26). Thus, the result of improved uniformity from rotating a wafer in an etchant is an *expected* result, versus an unexpected result.

In addition, we do not find Appellants’ evidence persuasive because the Specification examples are not commensurate in scope with representative claim 8. *See In re Peterson*, 315 F.3d 1325, 1330-31 (Fed. Cir. 2003). For example only, the claim defines a rotation of the wafer at *any* speed, including, *e.g.*, a speed of 25 rpm<sup>1</sup>. In contrast, example wafer B was continuously rotated at 1 rpm. Example wafer C was “sequentially” rotated at increments of 90° during a 200 second immersion, and example wafer E was likewise “sequentially” rotated during a 320-540 second immersion (*see Spec.* 12-13)<sup>2</sup>. The appeal record provides no way of knowing whether improved results would occur over the entire broad range claimed (*e.g.*, a rotational speed of .001 rpm versus no rotation, or 1000 rpm versus no rotation).

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<sup>1</sup> For example only, Erk describes a “typical” etching process wherein multiple wafers are placed in an etch rack which is immersed in an etchant, and the wafers are rotated in the etchant (col. 1, ll. 19-32). Erk teaches that when the rotational speed of the wafers is at “typical rotation speeds of 20 to 30 rpms”, there is a problem called “rigid-body effect” that renders the etchant acid between the wafers “stagnant”, resulting in nonuniform etching (Erk, col. 1, ll. 40-56).

<sup>2</sup> Assuming one complete revolution during the described etchant times, the “speed” of rotation of wafers C and E would be discontinuous, and overall on the order of 0.3 rpm for wafer C, and 0.1 - 0.2 rpm for wafer E.

These circumstances support our determination that the method defined by claim 8 would have been obvious to one with ordinary skill in this art in view of the prior art applied by the Examiner.

The § 103(a) rejection based on Erk, Datta, and Takeshi

*Dependent Claims 2, 3, 9, and 10*

We choose claim 9 to represent this claim grouping.

Claim 9 recites “wherein the step of rotating comprises sequentially rotating the semiconductor wafer”. The Examiner cites Takeshi to show that it was known in the prior art to sequentially rotate wafers and remove them during the etching process to check for defects (*see, e.g.*, Ans. 8; *see also* Appellants Spec. 4:4-11). We agree with the Examiner’s findings of fact based on Takeshi and conclusion of obviousness (*see, e.g.*, Ans. 8).

Appellants contend that Takeshi is nonanalogous art (App. Br. 11; Reply Br. 4) because it teaches a solution to a problem not faced by Appellants. We disagree. As discussed previously, one of ordinary skill in the art does not need to be motivated by the problem and solution identified by Appellants in order to combine the teachings of the references. *KSR*, 127 S. Ct. at 1742. Further, it is well established that in order to rely upon a reference as a basis for rejection, the Examiner may “show that a reference is either in the field of the applicant's endeavor or is reasonably pertinent to the problem with which the inventor was concerned.” *In re Kahn*, 441 F.3d 977, 986-87 (Fed. Cir. 2006).

We agree with the Examiner that Takeshi is in the same field of endeavor as Appellants', namely, etching semiconductor wafers (Ans. 13); and thus, we agree that Takeshi is analogous art.

We also note that one of ordinary skill in the art is also a person of ordinary creativity, not an automaton. *KSR*, 127 S. Ct. at 1742. We determine that one of ordinary creativity in the art would have readily appreciated that the sequential rotation and removal of the semiconductor wafers to check for defects as taught in Takeshi would have also been useful to check for other etching parameters, e.g., the degree of etching that has occurred. Thus, it would have also been prima facie obvious to have applied the sequential rotation steps as taught in Takeshi when etching the wafer of Datta in order to check on the degree of film removal that has occurred.

The § 103(a) rejection based on Erk, Datta, and Barbee

*Claims 7 and 15*

Appellants do not present any arguments with respect to the § 103 rejection of these claims. We agree with the Examiner's findings of fact and conclusion of obviousness (Ans. 5, 9).

Accordingly, we summarily affirm the Examiner's § 103 rejection of claims 7 and 15 based on the combined teachings of Erk, Datta, and Barbee.

CONCLUSION

In summary, we sustain:

1) the § 103 rejection based on Erk and Datta of claims 1, 4-6, 8, 11, 12, and 14;

2) the § 103 rejection based on Erk and Datta of claims 2, 3, 9, and 10;  
and

3) the § 103 rejection based on Erk, Datta, and Barbee of claims 7 and  
15.

The decision of the Examiner is affirmed.

No time period for taking any subsequent action in connection with this  
appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

tf/ljs

INTERNATIONAL BUSINESS MACHINES CORPORATION  
DEPT. 18G  
BLDG. 300-482  
2070 ROUTE 52  
HOPEWELL JUNCTION, NY 12533